Mem. Qd Mus. **18**(1): 41–51, pls. 16, 17. [1977]

THE FOSSIL VERTEBRATE FAUNA FROM PLEISTOCENE DEPOSITS AT CEMENT MILLS, GORE, SOUTHEASTERN QUEENSLAND

Alan Bartholomai
Queensland Museum

ABSTRACT

The fossil fauna from the cave and fissure-fill deposits at Cement Mills, Gore, southeastern Queensland is identified and shown to comprise 31 taxa, all but three of which are marsupial. Macropodids represent the most abundant remains preserved. Eighteen of the species are extinct and several others may ultimately prove new. With the exception of one of the extinct forms, the material permits reasonable correlation of the deposits with other Australian Pleistocene sediments, although some Late Pleistocene or Recent deposition is suggested by the large representation of extant species. The deposits are believed to have accumulated by a combination of marsupial predators and wash and fill processes.

Fossil vertebrate remains were first recorded from the cave and fissure-fill deposits at Cement Mills, Gore, southeastern Queensland, by Longman (1945). At that time, nine species, including a rodent and a bird, were noted in the fauna. Subsequently, the Queensland Museum has undertaken field work on the deposits on a number of occasions, resulting in a substantial increase in knowledge of the fauna. Aspects of the occurrence and various elements of the Cement Mills fauna have been described and discussed in a number of studies by Woods (1960) and Bartholomai (1963, 1968, 1970, 1971b).

The deposits occur in restricted limestone developments within the Palaeozoic rocks of the New England Fold Belt. Siemon (1973) indicates that the limestones quarried at Cement Mills form part of the Texas Beds of ?Upper Devonian to ?Upper Carboniferous age. These Beds comprise an intensely deformed sequence of 'flysch-like, regularly interbedded lithic sandstones and mudstones, with minor chert, jasper, intraformational conglomerate, intermediate volcanics, and limestone containing Visean corals'.

The fossil vertebrates occur sporadically where the cave earths have been intersected by the quarrying operations. Most are firmly cemented within the compact sediment, but it is apparent from the state of preservation of some of the earlier collections, that considerable material has come from essentially unconsolidated cave earths. Examination of the fossil deposits *in situ* has not succeeded in establishing any stratification within available cave earth sections.

A full discussion of the Cement Mills fauna is felt desirable to provide a basis for studies of other cave faunas in southeastern Queensland and eastern Australia generally.

Measurements throughout are in millimetres.

THE CEMENT MILLS FAUNA

Reptilia

Family Scincidae

Tiliqua scincoides (Shaw, 1790)
(Plate 16, fig. 1)

The Blue-tongue Lizard, *T. scincoides*, is known from a single specimen, F7709, a partial left dentary. The individual from which this was derived was relatively large. Longman (1945) erroneously identified this specimen as resembling *Trachysaurus rugosus*, another of the large scincid lizards.

Aves

Family Megapodiidae

Progura naracoortensis van Tets, 1974

Only one bird fossil, F2769, has as yet been recovered from the Cement Mills deposits. This was originally identified by Longman (1945) as the Scrub Turkey, *Alectura lathami*, but has been reassessed by van Tets (1974) as *Progura naracoortensis*.

TABLE 1: MANDIBULAR MEASUREMENTS—CEMENT MILLS FAUNA

Material	P_1	P_2	DP_3	P_3	M_1	M_2	M_3	M_4
Sarcophilus laniarius								
F3734	—	—	—	—	—	12·8× 8·6	14·0× 9·1	—
F3706	—	—	—	—	—	11·5× 7·6	13·7× 8·5	—
F3725	—	—	—	—	—	13·2× —	15·0× 9·3	16·9× 8·8
F3726	—	—	—	—	—	11·9× 7·8	—	—
F3708	—	7·6× 7·3	—	7·7× 6·0	10·0× 6·8	—	—	—
F2771	—	—	—	—	—	—	12·9× 7·9	13·9× 8·1
F3705	—	—	—	6·6× 6·7	10·6× 7·0	12·0× 7·6	14·3× 7·9	13·3× 7·2
F3704	—	—	—	—	9·8× 6·6	11·2× 7·2	12·2× 7·3	13·4× 6·8
F3733	—	—	—	—	10·3× 7·3	—	—	—
Thylacinus cynocephalus								
F3737	—	10·2× 4·2	—	—	—	—	—	—
F7345	—	—	—	—	—	—	—	16·4× —
Thylacoleo carnifex								
F5708	—	—	—	39·7×14·1	—	—	—	—
F7341	—	—	—	—	15·1×10·3	—	—	—
Vombatus ursinus								
F2774	—	—	—	6·4× 5·0	10·7× 6·0	11·2× 6·8	— × 6·9	—
F7364	—	—	—	6·8× 4·8	10·9× 6·2	11·9× 6·4	12·2× 7·5	—
F7348	—	—	—	—	9·6× —	—	—	—
F7349	—	—	—	6·0× 5·4	11·2× 5·5	12·0× 6·5	—	—
Phascolonus gigas								
F2772	—	—	—	18·3×12·0	22·7×13·8	24·1×14·2	—	—
*F7350	—	—	—	12·9× 8·7	22·5×12·0	—	—	—
Phascolomis cf. *P. magnus*								
F7351	—	—	—	—	—	—	17·8×12·3	—
F7352	—	—	—	—	19·3×10·6	—	—	—
Potorous aff. *P. tridactylus*								
F6092	—	3·5× 2·0	3·3× 1·8	5·2× 2·1	3·8× 2·6	4·2× 3·3	4·1× 3·3	—
F6093 (rt.)	—	—	—	5·6× 2·2	3·6× 2·6	—	—	—
F6093 (lt.)	—	—	—	5·8× 2·2	3·7× 2·5	—	—	—
Bettongia sp.								
F6134	—	—	—	6·5× 2·1	4·1× 2·9	4·3× 3·6	3·6× 3·4	3·1× 2·8
Protemnodon anak								
F7639	—	7·7× 3·9	—	12·3× —	9·0× 5·7	—	—	—
F7641	—	7·6× 4·0	9·1× 4·9	—	9·7× 6·0	—	—	—
Protemnodon brehus								
F7338	—	—	—	—	—	—	—	19·0×13·0
Protemnodon roechus								
F7336	—	—	—	— × 5·6	—	14·2× —	17·5× —	18·1×11·8

Thylogale sp.								
F7353	—	—	—	—	4·2 × 2·5	4·6 × 3·1	—	—
Macropus giganteus								
F2766	—	—	9·6 × 5·4	7·8 × —	11·7 × 6·6	13·5 × 8·1	14·6 × —	—
F7878	—	—	8·5 × 4·3	6·7 × 3·3	9·8 × 5·6	11·2 × 6·7	—	—
Macropus cf. *M. agilis siva*								
F7674	—	—	—	—	7·0 × —	8·8 × 6·4	10·0 × 6·7	— × 7·1
F7750	—	—	—	—	—	9·7 × 6·4	—	—

*Doubtfully referred.

TABLE 2: Maxillary Measurements—Cement Mills Fauna

Material	P1	P2	DP3	P3	M1	M2	M3	M4
Sarcophilus laniarius								
F3709	—	—	—	—	11·3 × 9·1	12·5 × 10·6	—	—
F3735	—	—	—	—	—	—	14·2 × 10·1	7·6 × 9·4
F3728	—	—	—	—	10·6 × 9·1	—	—	—
F3710	—	—	—	—	—	—	15·0 × 10·8	—
Isoodon sp.								
F2773	—	—	—	—	3·1 × 2·2	3·5 × 2·8	3·4 × 3·2	—
Thylacoleo carnifex								
F7342	—	6·2 × 5·4	—	—	—	—	—	—
F5710	—	—	—	52·2 × 15·5	—	—	—	—
Vombatus ursinus								
F7347	—	—	—	—	—	11·9 × 7·5	11·6 × 8·0	11·2 × 6·5
Palorchestes azael								
F3836	—	—	—	17·8 × 17·1	—	—	—	—
Palorchestes cf. *P. parvus*								
F7340	—	—	—	—	21·0 × 16·9	21·0 × 16·6	—	—
Potorous aff. *P. tridactylus*								
F6094	—	—	—	—	—	4·4 × 4·0	4·2 × 3·7	3·0 × 2·6
Macropus giganteus								
F7354	—	—	—	—	—	13·3 × 9·4	14·1 × 9·6	—
Macropus titan								
F7633	—	—	—	—	—	—	15·9 × 11·8	—
Macropus cf. *M. agilis siva*								
F7640	—	—	—	10·2 × 5·3	8·9 × 7·1	10·3 × 7·5	12·1 × 8·9	—

MAMMALIA

Superorder MARSUPIALIA

Family DASYURIDAE

Dasyurus aff. **D. viverrinus** (Shaw, 1800)
(Plate 16, fig. 4)

The only specimen of *Dasyurus* to have been recovered from the deposits, F3703, was considered by Bartholomai (1971b) who concluded that although no teeth are preserved, 'proportions of the ramus and its morphology suggest that it is . . . most likely of *D. viverrinus*'.

Sarcophilus laniarius (Owen, 1838)
(Plate 16, fig. 3)

S. laniarius is represented in the Cement Mills fauna by a relatively large sample comprising a partial skull, three maxillary specimens, 10 mandibular rami and 19 isolated teeth. No morphological differences are evident between this sample and material from the Pleistocene fluviatile deposits of the Darling Downs area, southeastern Queensland and elsewhere. Longman (1945) recognised the presence of this species in the deposit. Measurements are presented in Tables 1 and 2.

Family THYLACINIDAE

Thylacinus cynocephalus (Harris, 1808)
(Plate 16, fig. 7)

Two specimens of *T. cynocephalus* are present in the fauna, F3737, a partial right ramus with P_2 and P_3 broken, and F7345, an isolated right M_4. The posterior cingulum in P_2 is very reduced compared with material from other Pleistocene deposits but M_4 is morphologically identical with recent material used for comparison. Measurements presented in Table 1 fall within the range for recent material listed by Ride (1964), but slightly outside that for Eucla Division fossil thylacines from Western Australian caves (Lowry, 1972).

Family PERAMELIDAE

Isoodon sp.
(Plate 16, fig. 12)

The Short-nosed Bandicoots are represented by only two fragmentary specimens, one of which, F7847, a partial left ramus, lacks teeth. The other, F2773, a partial left maxilla with M^1–M^3, was mentioned by Longman (1945) as *I. obesulus*. While this specimen is undoubtedly referrable to *Isoodon* on morphological grounds, it is smaller than any modern specimens in the collections of the Queensland Museum. It is possible that it may prove distinct when a better and more complete sample is available. Its measurements are listed in Table 2.

Perameles nasuta Geoffroy, 1804
(Plate 16, fig. 6)

A reasonably large sample of *P. nasuta* is present in the Cement Mills collection, comprising three partial crania, two maxillae, 24 partial rami and three isolated molars. The majority of specimens represent juvenile individuals. Slight differences are evident between the fossil and extant samples of *P. nasuta*. In particular, the premolars appear less well-developed in the Cement Mills sample, while the canine also appears to be consistently smaller in similarly aged specimens. The differences do not appear sufficient to warrant separation of the Cement Mills material. Summaries of measurements appear in Table 3, while those for recent material are listed in Table 4.

Family PHASCOLARCTIDAE

Phascolarctos stirtoni Bartholomai, 1968

Bartholomai (1968) described this fossil koala from the Cement Mills deposits, distinguishing it from living koalas by a number of features including its much larger size and stronger accessory ridging in upper molars.

Family THYLACOLEONIDAE

Thylacoleo carnifex Owen, 1859

A reasonably large sample of *T. carnifex* is present in the Cement Mills fauna, suggesting that the caves and fissures may have provided lairs for this extinct animal. Differences between the present sample and that from the Pleistocene fluviatile deposits of the eastern Darling Downs are minor, P_3 being slightly less convex labially in occlusal view. This is interpreted as intraspecific variation. Longman (1945) noted the presence of this species in the fauna. Four mandibular and five maxillary fragmants are represented. Measurements for this sample appear in Tables 1 and 2.

Family VOMBATIDAE

Vombatus ursinus (Shaw, 1800)
(Plate 16, fig. 9)

V. ursinus is represented by five specimens, four of which are mandibular. The sample is morphologically inseparable from modern material, although the ramus in one of them, F7346, is slightly deeper than in the available extant sample. This is not, however, considered significant. Measurements are provided in Tables 1 and 2.

Phascolonus gigas (Owen, 1859)
(Plate 16, fig. 13)

A partial right ramus, F2772, is referred to *P. gigas*. All teeth present are broken, but sufficient

TABLE 3: SUMMARY OF MEASUREMENTS FOR *Perameles nasuta* GEOFFROY, 1804 (FOSSIL)

Character	Maxillae					Mandible				
	n	X	O.R.	s	V	n	X	O.R.	s	V
P^1_1 length	2	2·75	2·7–2·8	0·07	2·57	2	2·7	2·6–2·8	0·14	5·24
width posteriorly	2	0·8	—	—	—	2	0·7	—	—	—
P^2_2 length	5	2·76	2·6–2·9	0·11	4·13	5	3·10	3·0–3·4	0·17	5·59
width posteriorly	5	1·04	1·0–1·1	0·05	5·27	5	0·94	0·8–1·0	0·09	9·52
P^3_3 length	3	3·13	3·0–3·2	0·12	3·69	8	3·24	3·0–3·5	0·18	5·70
Width posteriorly	3	1·70	1·6–1·8	0·10	5·88	8	1·11	1·0–1·3	0·10	8·91
M^1_1 length	6	4·02	3·8–4·3	0·20	5·08	10	3·50	3·3–3·8	0·16	4·47
width protoloph (-id)	6	2·53	2·5–2·7	0·12	4·78	9	1·69	1·5–2·0	0·14	8·08
M^2_2 length	6	3·65	3·4–3·9	0·18	4·82	13	3·68	3·5–4·0	0·18	4·86
width protoloph (-id)	6	3·13	3·0–3·2	0·08	2·61	10	1·93	1·8–2·1	0·08	4·27
M^3_3 length	7	3·70	3·5–4·0	0·16	4·41	15	3·75	3·4–4·1	0·19	5·12
width protoloph (-id)	7	3·51	3·4–3·7	0·11	3·04	15	2·01	1·9–2·1	0·06	3·18
M^4_4 length	2	3·35	3·3–3·4	0·07	2·11	7	2·79	3·5–4·0	0·20	5·16
width protoloph (-id)	2	3·7	—	—	—	7	1·79	1·7–1·9	0·09	5·04

TABLE 4: SUMMARY OF MEASUREMENTS FOR *Perameles nasuta* GEOFFROY, 1804 (MODERN)

Character	Maxillae					Mandible				
	n	X	O.R.	s	V	n	X	O.R.	s	V
P^1_1 length	20	2·89	2·5–3·4	0·21	7·22	23	3·09	2·6–3·4	0·18	5·76
width posteriorly	20	1·04	1·0–1·2	0·07	6·48	23	0·93	0·7–1·1	0·09	10·00
P^2_2 length	24	2·90	2·5–3·3	0·18	6·23	23	3·40	3·1–3·8	0·16	4·56
width posteriorly	24	1·26	1·0–1·7	0·17	13·45	23	1·20	1·0–1·4	0·09	7·76
P^3_3 length	22	3·34	2·6–3·9	0·38	11·46	23	3·67	2·9–4·1	0·36	9·86
width posteriorly	22	1·70	1·4–2·3	0·23	13·71	23	1·42	1·2–1·6	0·13	8·99
M^1_1 length	20	4·07	3·6–4·4	0·21	5·05	23	3·52	3·1–3·9	0·21	5·98
width protoloph (-id)	20	2·88	2·6–3·8	0·31	10·82	23	1·96	1·6–2·2	0·14	7·20
M^2_2 length	20	4·06	3·6–4·4	0·22	5·40	24	3·93	3·4–4·2	0·19	4·89
width protoloph (-id)	20	3·40	3·0–3·9	0·28	8·30	24	2·26	1·9–2·4	0·14	6·36
M^3_3 length	20	4·32	4·0–4·6	0·23	5·28	23	4·07	3·6–4·4	0·18	4·52
width protoloph (-id)	20	3·84	3·5–4·6	0·33	8·47	23	2·36	1·9–2·6	0·16	6·60
M^4_4 length	22	3·63	2·7–4·6	0·36	9·93	22	4·29	3·4–4·8	0·33	7·66
width protoloph (-id)	22	3·71	3·1–4·3	0·39	10·52	22	2·20	1·8–2·4	0·14	6·58

remains for confident reference of the specimen. Longman (1945) also considered this specimen to be *P. gigas*. P_3 possesses well defined, mesial vertical grooves on its labial and lingual surfaces and is relatively elongate compared with the length of M_1.

A second specimen, F7350, while having M_1 similar in size and morphology to that in *P. gigas*, has a comparatively shallower ramus and a much shorter P_3. While these characters may represent extreme variation within *P. gigas*, the specimen may be related to *P. lemleyi* Archer, from the lower Pliocene Allingham Formation (Archer and Wade, 1976). Measurements for both specimens are presented in Table 1.

Phascolomis cf. **P. magnus** Owen, 1872
(Plate 16, fig. 2)

This form is known only from two isolated molars in the Cement Mills collection. Identification has been made on size alone, the specimens being intermediate to molars in *P. medius* Owen and *P. gigas*. Measurements appear in Table 1.

Family DIPROTODONTIDAE
Subfamily PALORCHESTINAE

Palorchestes azael Owen, 1874
(Plate 16, fig. 10)

An isolated left P^3, F3836, is referable to *P. azael*. It compares well with material from the

Pleistocene fluviatile deposits of the eastern Darling Downs, except that the posterior ridge from the parastyle is stronger in the Cement Mills specimen and there is no evidence of the presence of a labial cingulum. These differences are considered to represent intraspecific variation. Measurements appear in Table 2.

Palorchestes cf. **P. parvus** De Vis, 1895
(Plate 16, fig. 8)

A partial right maxilla, F7340, with M^1–M^2, compares reasonably well with specimens of *P. parvus* from the Chinchilla Sand, of Late Pliocene age. The specimen possesses very strong double linking across the median valley of M^1, while the vertical ridges on the posterior metaloph surface differ in strength, that from the hypocone being much better developed. All links in M^2 are single. In size, the specimen is similar to *P. parvus*, listed by Woods (1958), and its measurements are provided in Table 2.

Subfamily Nototheriinae

Nototherium inerme Owen, 1845
(Plate 16, fig. 4)

The largest diprotodontid present in the deposits, *N. inerme* is represented by F7339, a posterior one-half of M_4. This shows no wear on the lophid, but has a well-developed root, suggesting that it came from a sub-adult animal.

?Subfamily Zygomaturinae

Two isolated incisors although diprotodontid, cannot be referred with certainty because of lack of comparative material in Upper Cainozoic collections of the Queensland Museum. These specimens, F7343 and F7344, represent right and left I^2 respectively, both of which are small compared with worn examples of this tooth in the available *Zygomaturus trilobus* sample. They differ much more, however, from other Upper Cainozoic diprotodontid genera, and are clearly not referable to *Nototherium*, the other large diprotodontid in the Cement Mills fauna.

Family Macropodidae
Subfamily Potoroinae

Potorous aff. **P. tridactylus** (Kerr, 1792)
(Plate 17, fig. 1)

Material here referred to *Potorous* aff. *P. tridactylus* comprises F6092, a juvenile right ramus with I_1, P_2–M_3, P_3 excavated, F6093, associated rami with broken I_1, P_3–M_1, and F6094, an adult maxilla with M^2–M^4. The sample illustrates comparable upward phalangerine curviture of I_1, and basically similar premolar and molar structure to that in living *P. tridactylus*, but the molars are somewhat more quadrate. The fossils are all relatively small, falling slightly outside the smallest observations in living *P. tridactylus* in the Queensland Museum collections. They are within the range of the New South Wales sample in the Australian Museum, Sydney. In view of the common occurrence of M_5 in potoroos, the maxillary fossil may contain M^3–M^5 rather than M^2–M^4, although molar reduction and zygomatic arch position suggest the latter interpretation is correct. If so, M^4 is very reduced compared with *P. tridactylus* and is more comparable with that in living *P. gilberti* now regarded by Ride (1970) as a western form of *P. tridactylus*. Measurements for the sample are provided in Tables 1 and 2.

Aepyprymnus rufescens (Gray, 1837)
(Plate 16, fig. 11)

A large sample of *A. rufescens* has been recovered from the Cement Mills deposits and comprises five partial skulls, three partial maxillae, eight partial rami and six isolated teeth. Summaries of measurements for this sample are presented in Table 5, while those for living *A. rufescens* appear in Table 6. No significant size differences occur between the samples, the greatest C.D. being 0·71 in M^4 length.

The deciduous upper premolar is considered by Tate (1948) to possess five or six grooves, while P^3 is stated to have seven or eight grooves. The extant sample considered here agrees with the number of grooves indicated for P^2, but five are more commonly present (92%, n=24). Number of grooves for P^3 ranges from six to nine, with seven being most common (72%, n=43). The fossil sample is slightly more variably in grooving of P^3 but not of P^2. In P^3, the range is from five to nine grooves. Lower premolars in fossil and recent samples agree well in variation in groove count.

The Cement Mills sample has been compared also with a small sample of fossil *Aepyprymnus* from the eastern Darling Downs and no differences are apparent.

Bettongia sp.
(Plate 17, fig. 8)

A partial right ramus, F6134, with P_3–M_4, has been recovered from the deposits. Because of its small size (see Table 1) specific status may be warranted when more material becomes available. The posterior cheek teeth are very small, P_3 is offset from the general line of the cheek teeth and its crest approximately parallels the lower enamel margin of the tooth; seven intermediary ridges are present

TABLE 5: SUMMARY OF MEASUREMENTS FOR *Aepyprymnus rufescens* (GRAY, 1837), CEMENT MILLS SAMPLE

	Maxillae					Mandibles				
Character	n	X	O.R.	s	V	n	X	O.R.	s	V
P_2^2 length	3	7·0	6·5–7·6	0·55	7·89	4	6·4	5·7–7·0	0·59	9·24
width posteriorly	3	3·5	3·4–3·5	0·07	2·02	4	3·1	2·9–3·4	0·26	8·53
DP_3^3 length	4	5·3	5·1–5·7	0·29	5·45	3	5·3	5·1–5·4	0·17	3·27
width protoloph (-id)	4	3·7	3·5–3·9	0·21	5·62	3	3·2	3·0–3·4	0·21	6·57
P_3^3 length	9	9·4	8·5–10·9	0·78	8·33	6	8·9	8·6–9·5	0·32	3·62
width posteriorly	5	3·4	3·3–3·7	0·17	4·88	5	3·4	3·3–3·5	0·07	2·08
M_1^1 length	9	5·5	5·0–5·9	0·28	5·10	6	5·5	4·7–5·9	0·41	7·54
width protoloph (-id)	8	4·6	4·4–4·8	0·15	3·28	6	3·8	3·4–4·1	0·26	6·86
M_2^2 length	10	6·3	5·6–6·9	0·47	7·50	4	6·5	5·9–6·9	0·46	7·14
width protoloph (-id)	9	5·0	4·6–5·4	0·32	6·48	4	4·6	4·4–4·7	0·15	3·32
M_3^3 length	10	6·5	6·0–7·1	0·34	5·20	5	7·1	6·5–7·6	0·49	6·86
width protoloph (-id)	10	5·0	4·8–5·2	0·11	2·11	4	5·2	5·1–5·4	0·15	2·93
M_4^4 length	7	5·5	4·7–6·4	0·65	11·83	—	—	—	—	—
width protoloph (-id)	4	4·0	3·6–4·9	0·62	15·49	—	—	—	—	—

TABLE 6: SUMMARY OF MEASUREMENTS FOR *Aepyprymnus rufescens* (GRAY, 1837), RECENT SAMPLE

	Maxillae					Mandibles				
Character	n	X	O.R.	s	V	n	X	O.R.	s	V
P_2^2 length	10	7·1	6·7–7·8	0·32	4·48	10	6·3	5·6–6·6	0·28	4·52
width posteriorly	10	3·2	2·9–3·5	0·18	5·51	10	3·0	2·8–3·2	0·13	4·44
DP_3^3 length	10	5·7	5·5–5·9	0·15	2·63	10	5·2	4·5–5·6	0·32	6·08
width protoloph (-id)	10	3·7	3·4–3·9	0·17	4·51	10	2·8	2·5–3·0	0·18	6·30
P_3^3 length	16	9·5	9·0–10·1	0·32	3·41	16	8·5	7·8–9·4	0·40	4·71
width posteriorly	16	3·5	3·1–4·1	0·25	7·20	16	3·2	2·9–3·5	0·17	5·47
M_1^1 length	22	5·8	5·0–6·4	0·41	7·00	19	5·3	4·6–6·2	0·38	7·21
width protoloph (-id)	22	4·3	3·9–4·7	0·20	4·54	19	3·7	3·4–4·1	0·20	5·29
M_2^2 length	26	6·6	5·5–7·4	0·41	6·28	24	6·1	5·5–7·0	0·35	5·66
width protoloph (-id)	26	4·8	4·2–5·2	0·21	4·33	24	4·4	4·2–4·7	0·15	3·51
M_3^3 length	17	6·9	6·0–7·6	0·43	6·23	18	6·5	5·8–7·1	0·39	5·95
width protoloph (-id)	18	4·8	4·5–5·2	0·16	3·35	19	5·0	4·6–5·3	0·18	3·58
M_4^4 length	10	6·3	5·5–7·0	0·48	7·68	10	6·0	5·6–6·5	0·37	6·19
width protoloph (-id)	11	4·2	3·8–4·7	0·27	6·52	10	4·6	4·1–4·9	0·26	5·71

between those from the anterior and posterior cuspids; anterior cingula of molars are broad.

Comparison with recent species is difficult bcause of poor representation of eastern Australian species of *Bettongia* in collections, and some taxonomic uncertainty regarding the material that is held. Wakefield (1967) has reviewed *Bettongia* and on the basis of information presented there, together with the figure of the skull of the holotype of *B. gaimardi* illustrated in Quoy and Gaimard (1842), F6134 compares better morphologically with this species than with others currently known. It is, however, much smaller.

Finlayson (1959) has recorded a 'microdont phase of *B. cuniculis*' in subfossil South Australian collections suggesting that size alone may not be a sufficient basis for separation within the genus.

Subfamily STHENURINAE

Sthenurus oreas De Vis, 1895

Bartholomai (1963) described and figured a partial maxilla, F3814, which was referred to this species. No other specimens referable to *Sthenurus* have been located as yet in the Cement Mills deposits.

Procoptodon cf. **P. rapha** Owen, 1874
(Plate 17, fig. 3)

The single ramus, F4548, compared with *P. rapha* by Bartholomai (1970), shows reduced ornamentation of teeth but is otherwise inseparable from that species. It may represent extreme intraspecific variation, but in the absence of intermediaries, its assignment cannot be made with certainty.

Subfamily Macropodinae

Protemnodon anak Owen, 1874
(Plate 17, fig. 10)

Protemnodon anak is represented by two juvenile specimens, F7639 and F7641, in the Cement Mills deposits. These mandibles are morphologically inseparable from the eastern Darling Downs sample (Bartholomai, 1973). Their measurements are included in Table 1.

Protemnodon brehus (Owen, 1874)
(Plate 17, fig. 14)

An isolated left M_4, F7338, is referred to *P. brehus*. This is morphologically identical to eastern Darling Downs material revised by Bartholomai (1973). Measurements for this specimen are presented in Table 1.

Protemnodon roechus Owen, 1874
(Plate 17, fig. 11)

Two mandibular specimens are referred to *P. roechus*. A partial left mandibular ramus, F7336, is small compared with the bulk of the eastern Darling Downs sample examined by Bartholomai (1973), falling near lower limits for tooth size in that population. Its measurements are provided in Table 1. The posterior cingulum in M_4 in F7336, is well-defined, rare in the eastern Darling Downs sample. The second specimen, an isolated right I_1, is also small compared with the Darling Downs material.

Thylogale sp.
(Plate 17, fig. 2)

The single specimen referred to *Thylogale* sp., F7353, is a partial adult right ramus with M_1–M_2. As seen in Table 1, teeth are small but they compare well with small individuals of modern *T. thetis* and *T. stigmatica* in the Queensland Museum collections. Links appear slightly less developed in the fossil. Large samples would be required to provide specific identification within this genus.

Macropus giganteus Shaw, 1790
(Plate 17, fig. 6)

M. giganteus is represented by three specimens, F2766, a partial left ramus with DP_3–M_3, P_3 excavated, F7878, a partial left ramus with DP_3–M_2, P_3 excavated, and F7354, a partial right maxilla with M^2–M^3. Measurements for these are provided in Tables 1 and 2. Compared with measurements for recent *M. giganteus* in Bartholomai (1971a), the teeth in F2766 are relatively more elongate than usual, but this difference is not considered significant.

Macropus titan Owen, 1838
(Plate 17, fig. 13)

The extinct *M. titan* is known from only one specimen, F7633, an isolated, unerupted left M^3. Its measurements are presented in Table 2. In size and morphology, this specimen is within the range indicated for eastern Darling Downs specimens considered by Bartholomai (1975).

Macropus cf. **M. agilis siva** (De Vis, 1895)
(Plate 17, fig. 5)

The specimens referred to *Macropus* cf. *M. agilis siva* agree in size, but differ slightly in morphology from the large eastern Darling Downs sample considered by Bartholomai (1975). F7640, a partial left maxilla with P^3–M^3, differs in lacking any trace of an accessory link on the trigonid in anterior molars. This feature is not present in all specimens

TABLE 7: Summary of Measurements for *Macropus dorsalis*, Cement Mills Sample

Character	Maxillae					Mandible				
	n	X	O.R.	s	V	n	X	O.R.	s	V
P^2_2 length	1	5·0	—	—	—	1	5·0	—	—	—
width posteriorly	—	—	—	—	—	1	2·6	—	—	—
DP^3_3 length	2	5·7	5·4–6·0	0·42	7·44	3	5·93	5·8–6·1	0·15	2·57
width protoloph (-id)	1	4·0	—	—	—	3	3·47	3·2–4·0	0·46	13·32
P^3_3 length	2	6·45	6·3–6·6	0·21	3·29	1	5·9	—	—	—
width posteriorly	1	3·0	—	—	—	—	—	—	—	—
M^1_1 length	7	6·37	6·0–7·3	0·43	6·82	7	6·63	6·2–7·4	0·38	5·76
width protoloph (-id)	5	4·68	4·3–5·3	0·38	8·05	7	4·07	4·0–4·2	0·08	1·86
M^2_2 length	10	7·66	6·8–8·9	0·72	9·40	10	7·25	5·9–8·4	0·80	11·02
width protoloph (-id)	6	5·90	5·3–6·4	0·55	9·35	13	4·68	4·1–5·6	0·36	7·79
M^3_3 length	8	8·55	7·7–9·7	0·67	7·78	16	8·31	7·8–8·8	0·33	3·97
width protoloph (-id)	8	6·18	5·4–7·1	0·63	10·20	17	5·36	4·9–5·7	0·21	3·90
M^4_4 length	4	8·93	8·2–9·2	0·49	5·44	10	8·65	8·3–9·2	0·27	3·09
width protoloph (-id)	4	6·55	6·2–6·7	0·24	3·63	12	5·62	5·3–5·8	0·13	2·38

in the Darling Downs sample. Measurements for the Cement Mills material are provided in Tables 1 and 2. Definite reference of the material to *M. agilus siva* would be premature.

Macropus dorsalis (Gray, 1837)
(Plate 17, fig. 7)

A reasonably large sample of *M. dorsalis* comprises one partial skull, 13 maxillae, 30 mandibular rami and numerous isolated incisors. The sample is identical with modern material in the collections of the Queensland Museum. As with other larger macropodines, most of the sample has been drawn from juvenile individuals. Summaries of maxillary and mandibular measurements are provided in Table 7.

Macropus parryi (Bennett, 1835)
(Plate 17, fig. 12)

The sample referred to *M. parryi* represents the largest number of individuals in the deposits. It comprises one partial skull, four premaxillae, 24 maxillae, 69 mandibular rami, 10 isolated molars and numerous isolated incisors. Many of the specimens are juvenile. No differences are apparent between this sample and recent *M. parryi* in the Queensland Museum collections. A summary of maxillary and mandibular measurements is provided in Table 8.

EUTHERIA

RODENTIA

Gen. and sp. indet.
(Plate 17, fig. 9)

Rodents are relatively poorly represented in the Cement Mills deposits. Only four specimens have been recovered, these comprising F7634, a partial left maxilla, F7635, an isolated upper incisor, F7636, a fragmentary partial right ramus and F7637, a partial right mandibular ramus. The material is obviously not hydromyine.

DISCUSSION

The fossil fauna from the cave and fissure-fill deposits at Cement Mills, Gore, southeastern Queensland is a remarkably diverse assemblage of vertebrates. While several taxa are sufficiently well represented to permit statistical evaluation of the population from which they were drawn, the majority reflect small sample numbers.

Within statistically assessed populations it is apparent that somewhat anomalous values for the Coefficient of Variation are sometimes present. The fossil sample of *Perameles nasuta* frequently exhibits lower values for V in the characters examined than does the available living sample. In absolute terms, this living sample compares well with the larger sample of *P. nasuta* examined by Freedman and Joffe (1967), but has some values for V which are higher. It is believed that the anomaly, which is independent of the fossil sample, reflects peculiarities of the modern sample available in the Queensland Museum. High values for V are evident in posterior molars within both the living and fossil samples of the potoroine *Aepyprymnus rufescens*, especially where such values are compared with those for selected macropodines (Bartholomai, 1971a). The fossil sample for *Macropus dorsalis* exhibits a number of abnormal values for V, but in this case, small sample size is most likely responsible. Values more comparable with those

TABLE 8: SUMMARY OF MEASUREMENTS FOR *Macropus parryi*, CEMENT MILLS SAMPLE

Character	Maxillae					Mandible				
	n	X	O.R.	s	V	n	X	O.R.	s	V
P^2_2 length	2	5·7	5·1–6·3	0·85	14·89	1	4·5	—	—	—
width posteriorly	2	3·2	2·8–3·6	0·57	17·68	1	2·3	—	—	—
DP^3_3 length	1	7·2	—	—	—	9	6·26	5·9–6·7	0·28	4·53
width protoloph (-id)	—	—	—	—	—	8	3·31	2·9–3·9	0·30	9·05
P^3_3 length	3	6·4	5·7–7·3	0·82	12·79	15	4·20	3·7–4·8	0·34	8·00
width posteriorly	3	3·17	2·7–3·9	0·64	20·30	6	2·22	2·1–2·4	0·12	5·27
M^1_1 length	14	7·29	6·6–8·2	0·38	5·23	36	6·73	5·8–7·6	0·47	7·03
width protoloph (-id)	12	5·76	5·5–6·0	0·18	3·18	35	4·23	3·8–5·00	0·29	6·92
M^2_2 length	18	8·51	8·1–9·1	0·31	3·67	36	7·82	6·8–8·8	0·47	6·02
width protoloph (-id)	18	6·45	5·9–7·0	0·27	4·23	36	5·00	4·6–5·7	0·27	5·34
M^3_3 length	12	9·50	8·9–10·3	0·40	4·16	34	8·70	8·0–9·2	0·30	3·40
width protoloph (-id)	11	7·13	6·6–8·0	0·41	5·82	36	5·74	5·1–6·2	0·23	4·07
M^4_4 length	6	9·30	8·9–9·7	0·30	3·26	13	9·15	8·8–9·7	0·24	2·62
width protoloph (-id)	8	6·88	6·6–7·2	0·21	3·09	19	5·84	5·4–6·2	0·18	3·09

provided for other macropodines in Bartholomai (1971a) are evident in the large sample of *M. parryi* examined.

From the relatively large numbers of marsupial carnivores represented, comprising *Dasyurus* aff. *D. viverrinus*, *Sarcophilus laniarius*, *Thylacinus cynocephalus* and *Thylacoleo carnifex*, it is apparent that the caves and fissures acted as lairs during the past. This is supported by the fragmentary and juvenile nature of much of the material, although bones exhibiting tooth marks have not been recorded. Small to medium-sized herbivores are especially well represented. Undoubtedly, however, some bone was contributed by wash and fill processes.

A relatively high proportion of the fauna is of recent species or of forms closely related to living species. Compared with the recorded fauna from the Pleistocene fluviatile deposits of the eastern Darling Downs, this difference is particularly apparent. Fossil species predominate in the Darling Downs deposits. Sufficient extinct species are present at Cement Mills to indicate that most of the sediments were accumulated during the Pleistocene. However, some of the fauna was probably deposited late in the Pleistocene or even in Recent times. There is an absence of evidence for stratification within the deposits, but the presence of both *Macropus titan* and *M. giganteus* suggests that different times of deposition are most likely involved. Bartholomai (1975) has suggested the possibility of close phylogenetic relationships between *M. titan* and *M. giganteus*.

The presence of species such as *Perameles nasuta*, *Potorous* aff. *P. tridactylus* and *Thylogale* sp., usually found in rain forests, in an assemblage which could otherwise be interpreted as representing an open sclerophyll situation further suggests that deposition was over a time sufficient to permit fluctuations of climate to influence the habitats in the close vicinity.

One taxon, *Palorchestes* cf. *P. parvus* is problematical in this interpretation of the age of deposition. Woods (1958) has shown that *P. parvus* is most likely known only from the Chinchilla Sand, now regarded as being of Late Pliocene age (Bartholomai, 1973). However, the Cement Mills record is an isolated specimen and as such could ultimately prove distinct, or could involve an extension of range for *P. parvus*. It is considered less likely that older deposits are represented at Cement Mills.

LITERATURE CITED

ARCHER, M. and WADE, M., 1976. Results of the Ray E. Lemley Expeditions, part 1. The Allingham Formation and a new Pliocene vertebrate fauna from northern Queensland. *Mem. Qd Mus.* **17**: 379–96.

BARTHOLOMAI, A., 1963. Revision of the extinct macropodid genus *Sthenurus* Owen in Queensland. *Mem. Qd Mus.* **14**: 51–76.

1968. A new fossil koala from Queensland and a reassessment of the taxonomic position of the problematical species, *Koalemus ingens* De Vis. *Mem. Qd Mus.* **15**: 65–71.

1970. The extinct genus *Procoptodon* Owen (Marsupialia: Macropodidae) in Queensland. *Mem. Qd Mus.* **15**: 213–33.

1971a. Morphology and variation in the cheek teeth in *Macropus giganteus* Shaw and *Macropus agilis* (Gould). Mem. Qd Mus. **16**: 1–18.

1971b. *Dasyurus dunmalli*, a new species of fossil marsupial (Dasyuridae) in the Upper Cainozoic deposits of Queensland. *Mem. Qd Mus.* **16**: 19–26.

1973. The genus *Protemnodon* Owen (Marsupialia: Macropodidae) in the Upper Cainozoic deposits of Queensland. *Mem. Qd Mus.* **16**: 309–63.

1975. The genus *Macropus* Shaw (Marsupialia: Macropodidae) in the Upper Cainozoic deposits of Queensland. *Mem. Qd Mus.* **17**: 195–235.

FINLAYSON, H. H., 1959. Subfossil Potoroinae (Marsupialia) from South Australia. *Trans. R. Soc. S. Aust.* **82**: 291–300.

FREEMAN, L., and JOFFE, A. D., 1967. Skull and tooth variation in the genus *Perameles*. Pt. 2: Metrical features of *P. nasuta*. *Rec. Aust. Mus.* **27**: 183–95.

LONGMAN, H. A., 1945. Fossil vertebrates from the Gore quarries. *Mem. Qd Mus.* **12**: 164.

LOWRY, J. W. J., 1972. The taxonomic status of small fossil thylacines (Marsupialia, Thylacinidae) from Western Australia. *J. R. Soc. W. Aust.* **55**: 19–29.

QUOY, J. R. C., and GAIMARD, P., 1824. Zoologie. *In* FREYCINET, Voyage autour du monde, Uranie et Physicienne, 1817–1820.

RIDE, W. D. L., 1964. A review of Australian fossil marsupials. *J. R. Soc. W. Aust.* **47**: 97–131.

1970. 'A Guide to the Native Mammals of Australia'. pp. xi + 249 (Oxford University Press: Melbourne).

SIEMON, J. E., 1973. Limestone resources of the Warwick-Texas area. *Rep. Geol. Surv. Qd* **80**: 1–47.

TATE, G. H. H., 1948. Studies on the anatomy and phylogeny of the Macropodidae (Marsupialia). Results of the Archbold Expeditions, No. 59. *Bull. Amer. Mus. Nat. Hist.* **91**: 237–351.

VAN TETS, G. F., 1974. A revision of the fossil Megapodiidae (Aves), including a description of a new species of *Progura* De Vis. *Trans. R. Soc. S. Aust.* **98**: 213–24.

WAKEFIELD, N. A., 1967. Some taxonomic revision in the Australian marsupial genus *Bettongia* (Macropodidae), with a description of a new species. *Vic. Nat.* **84**: 8–22.

WOODS, J. T., 1958. The extinct marsupial genus *Palorchestes* Owen. *Mem. Qd Mus.* **13**: 177–93.

1960. Fossiliferous fluviatile and cave deposits, *in* D. HILL and A. K. DENMEAD, Editors, 'The Geology of Queensland'. *J. Geol. Soc. Aust.* **7**: 393–403.